A NEW VULTURE (VULTURIDAE: *PLIOGYPS*) FROM THE LATE MIOCENE OF FLORIDA

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Abstract.—A new vulture, *Pliogyps charon* n. sp., from the late Miocene (latest Clarendonian) Love Bone Bed locality, Alachua Co., Florida, is described from a complete tarsometatarsus and referred distal ends of the tibiotarsus and humerus. *Pliogyps charon* is distinguished from *Pliogyps fisheri* Tordoff (1959) by smaller size, and by proportions and qualitative characters of the tarsometatarsus.

Pre-Quaternary vultures are poorly known. Recently, Olson (1985) reviewed the fossil history of this family. The earliest record of the family Vulturidae is from the late Eocene and early Oligocene deposits of the Phosphorites du Quercy, France, and in the early Oligocene of Mongolia. In South America, the oldest vulture is *Dryornis pampeanus* Moreno and Mercerat, from the Monte Hermoso Formation in Argentina, which is probably close to the living genus *Vultur* (Tonni 1980). The oldest records of vultures in North America are *Sarcoramphus kernensis* from the late Miocene (mid-Hemphillian) of Kern River, California, and a specimen under study from the mid-Barstovian Sharkstooth Hill local fauna (Emslie, pers. comm.). While there are several described genera and species of vultures from the Pliocene and Pleistocene (Brodkorb 1964, Olson 1985), the true number of valid taxa among them remains to be determined.

This paper describes a new species of New World vulture (Family Vulturidae), discusses functional aspects of the genus *Pliogyps,* and comments on the generic status of living and fossil members of this group.

Material and Methods

Recent specimens examined are in the Florida State Museum, the collection of Pierce Brodkorb, and the National Museum of Natural History. Recent skeletons of Vulturidae examined: *Gymnogyps californianus,* 7; *Vultur gryphus,* 9; *Sarcoramphus papa,* 9; *Coragyps atratus,* 16; *Cathartes aura,* 4. Fossil specimens are in the vertebrate paleontology collections of the Florida State Museum (UF) and the Museum of Paleontology, University of Michigan. Anatomical terminology follows Baumel et al. (1979). Measurements, defined in Table 1 and Figs. 2 and 3, were taken with dial calipers accurate to 0.05 mm, and rounded to the nearest 0.1 mm.

Systematics

Order Accipitriformes (Vieillott, 1816)
Family Vulturidae (Illiger, 1811)
Pliogyps Tordoff, 1959

Emended generic diagnosis.—Tarsometatarsus of *Pliogyps* differing from that of other living and fossil genera of vultures in having a proportionately large trochlea for digit III, proximal articular surface wide and deep in comparison to length of bone, a generally columnar form, with symmetrical lateral and medial flaring, both proximally and distally; shaft wide in comparison to length of bone; hypotarsus merging distally with shaft by means of broad, rounded ridge (as in *Vultur, Breagyps, Gymnogyps,* and *Geranogyps*; more narrow in *Coragyps, Cathartes,* and *Sarcoramphus*). This last

character may be strictly size dependent and if so, not of value as a generic character.

Remarks. — Two characters (shaft less deeply and extensively excavated anteriorly; groove of trochlea for digit III ending anteroproximally in a shallow, but distinct pit) used by Tordoff (1959) to define this genus are variable within a given species, and therefore should not be used as generic characters.

Pliogyps charon, new species
Fig. 1

Holotype. — UF 25952, complete right tarsometatarsus, missing a small portion of hypotarsus.

Paratype. — UF 25886, distal end left tibiotarsus.

Referred material. — UF 25719, fragment of shaft of left humerus, tentatively referred.

Type locality. — Love Bone Bed local fauna, along State Road 241, near Archer, Alachua County, Florida (NW ¼, SW ¼, NW ¼, Sec. 9, T. 11 S., R. 18 E., Archer Quadrangle, U.S. Geologic Survey 7.5 minute series topographical map, 1969). Fossil vertebrates occurring in the Alachua Formation (Williams et al. 1977) are considered latest Clarendonian in age (Webb et al. 1981), about 9 million years before present. The known avifauna of the Love Bone Bed is primarily aquatic, with a few terrestrial species being present (Becker 1985a, b).

Diagnosis. — Tarsometatarsus distinguished from that of *Pliogyps fisheri* Tordoff (1959) in smaller size, in having a narrow ridge extending from hypotarsus farther down shaft (caudal view), in having sulcus extensorius more excavated and extending farther down shaft (cranial view), and in having shaft and trochlea III proportionately less deep.

Etymology. — The specific name *charon,* Greek, masculine, is a noun in apposition. In Greek mythology Charon, portrayed as a robust old man, ferries the souls of the dead across the River Styx (considered by

Table 1. — Measurements of the tibiotarsi and tarsometatarsi of the vultures *Coragyps atratus atratus* (n = 16, 8 males, 8 females), *Pliogyps fisheri,* and *Pliogyps charon,* new species. Data are mean ± standard deviation and range. Measurements of tibiotarsus are W-DIST-CR, Transverse width of distal end, measured across cranial portion of condyles; D-MCON, Greatest depth of medial condyle. Measurements of tarsometatarsus: LENGTH, Greatest length from intercondylar eminence (Eminentia intercondylaris) through trochlea for digit III (Trochlea metatarsi III). W-PROX, Greatest transverse width proximal articular surface, measured across dorsal surface. D-PROX, Depth of proximal end, measured from dorsal edge of the proximal articular surface through the lateral hypotarsal crest (Crista lateralis hypotarsi). W-DIST, Greatest transverse width of distal end. W-TRIII, Greatest transverse width of trochlea III. D-TRIII, Greatest depth of trochlea III. Measurements of *Coragyps* are included to show amount of variation present in a living population of vultures.

Measurements	C. a. atratus	P. fisheri	P. charon
Tibiotarsus			
W-DIST-CR	12.79 ± 0.41 12.1–13.6	—	19.5
D-MCON	13.67 ± 0.41 13.2–14.6	—	[18.1]
Tarsometatarsus			
LENGTH	84.43 ± 1.54 80.4–87.1	94.0	86.6
W-PROX	15.11 ± 0.53 14.1–16.2	21.9	21.1
D-PROX	11.71 ± 0.42 11.1–12.4	—	—
W-DIST	16.59 ± 0.57 15.6–17.6	33.0	—
W-TRIII	6.43 ± 0.21 6.0–6.7	9.6	9.2
D-TRIII	9.99 ± 0.32 9.4–10.6	15.2	13.5

some authorities to be the River Acheron) into the lower world. This name also reflects the proximity of a modern River Styx, located 18 miles due east of the Love Bone Bed locality on the northern edge of Orange Lake, Alachua County, Florida.

Description. — In cranial view, the proximal vascular foramina are large and are approximately equal in size. The papilla for
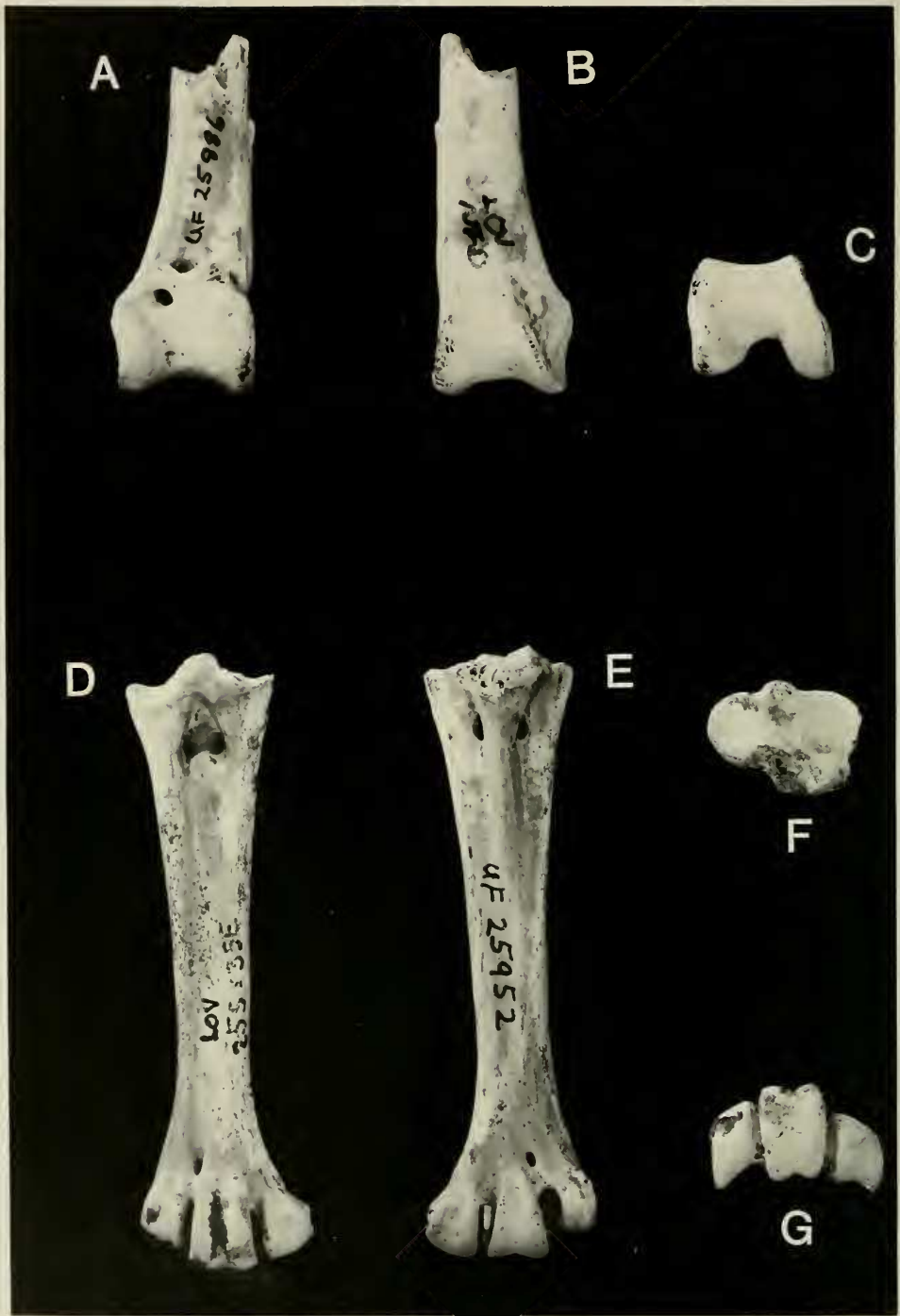
Fig. 1.   Photographs of holotype and paratype of *Pliogyps charon,* new species. A–C, UF 25886, distal end of left tibiotarsus, paratype. D–G, UF 25952, right tarsometatarsus, holotype. A, D, Cranial (dorsal) view; B, E, Caudal (plantar) view; C, G, Distal end view; F, Proximal end view.
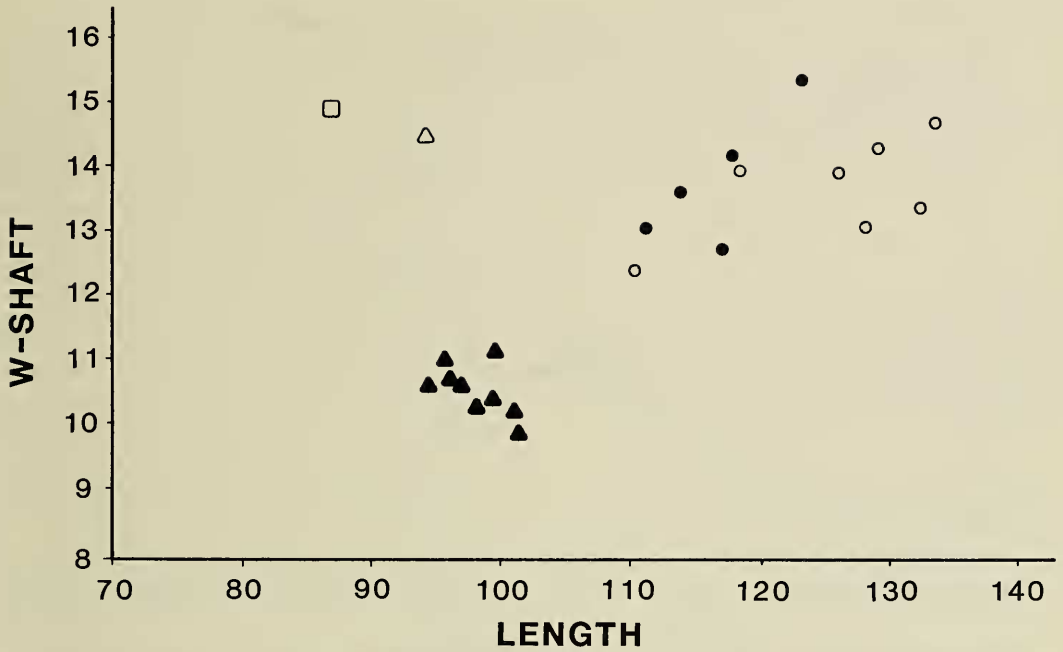
Fig. 2. Bivariate plot of greatest length from intercondylar eminence (Eminentia intercondylaris) through trochlea for digit III (Trochlea metatarsi III) (LENGTH) versus transverse width of shaft (W-SHAFT) of the tarsometatarsi of the following species of vultures: open square—*Pliogyps charon*, new species, open triangle—*Pliogyps fisheri*, solid triangles—*Sarcoramphus papa*, open circles—*Vultur gryphus*, solid circles—*Gymnogyps californianus*.

the attachment of M. tibialis cranialis is rounded and is in two parts. The sulcus extensoris, with a sharp lateral border, extends down the shaft to the distal foramen. A distinct intermuscular line extends obliquely through this sulcus (separating attachments for the extensor digitorum brevis pars hallucis and extensor digitorum brevis pars adductor-extensor digiti IV; Jollie 1977:43). In caudal view, the tarsometatarsus has a long ridge extending down the shaft from the hypotarsus. This ridge terminates in an intermuscular line that extends to the level of the articular facet of metatarsal I.

The distal end of tibiotarsus has a broad extensor sulcus. There is a slight projection of bone on the lateral surface of the distal end (approximately 4 cm from distal end) for attachment of the fibula. The intercondylar sulcus is broad, and the external condyle merges evenly into it. In distal end view, the intercondylar sulcus is asymmetrical, with the lateral border sloping gradually, and the medial border sloping abruptly, up from the base of the intercondylar sulcus (symmetrical or U-shaped in *Coragyps*, *Sarcoramphus*, *Breagyps*, *Gymnogyps*; asymmetrical in *Cathartes*). Measurements are given in Table 1. Humerus fragment tentatively referred.

Discussion. —There is a strong correlation between the cross-sectional area of the tibiotarsus of a given avian species and its live weight (Campbell and Tonni 1983, Prange et al. 1979). The following empirically derived regression equation,

$$\log Y = 2.54 \log X - 0.19906$$

where Y is the live body weight (gms) and X is the least shaft circumference of the tibiotarsus (mm), has a correlation coefficient of 0.986, showing that the predictions of the
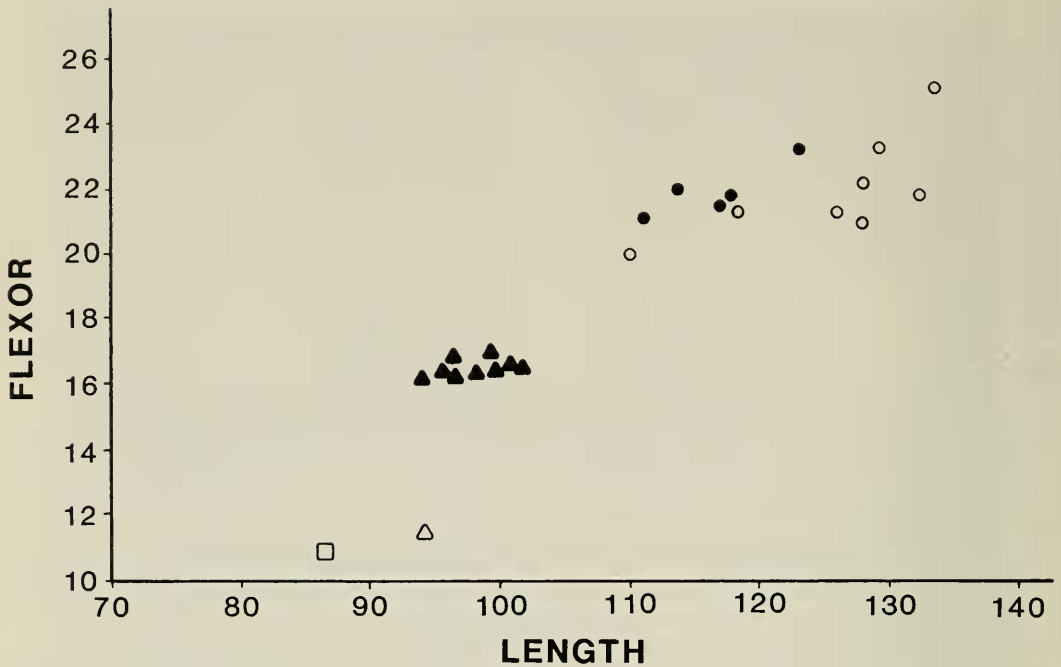
Fig. 3.   Bivariate plot of greatest length (LENGTH) versus length from intercondylar eminence to middle of tubercle for tibialis anterior (Tuberositas m. tibialis cranialis) (FLEXOR) of tarsometatarsi of the following species of vulture: open square—*Pliogyps charon,* new species, open triangle—*Pliogyps fisheri,* solid triangles—*Sarcoramphus papa,* open circles—*Vultur gryphus,* solid circles—*Gymnogyps californianus.*

live weight should be very accurate. The least shaft circumference of the paratype of *Pliogyps charon* (UF 25886) measures 32 mm, yielding a predicted weight of 5.2 kg. *Sarcoramphus papa,* which has a similar tarsometatarsal length, weighs between 3.0 and 3.75 kg (5 individuals, Brown and Amadon 1968). This supports Tordoff's (1959:341ff) contention that *Pliogyps* is relatively a heavy-bodied, short-legged vulture.

Figures 2 and 3 show the length of the tarsometatarsus plotted against the width of the shaft and the flexor length. Species of *Pliogyps* have an average flexor length, but a very broad tarsometatarsus in comparison to its length. When considered in conjunction with the well-developed muscle attachments discussed above, a powerful pelvic limb is suggested. It is possible that *P. charon* was more rapacious than other living or fossil vultures, or that this powerful pelvic limb is merely a reflection of a heavy body. As additional fossil material of this species becomes available, these tentative suggestions should be examined further.

The intergeneric relationships of living and fossil vultures are difficult to determine, owing to a paucity of pre-Pleistocene fossil specimens and the conservative nature of the tarsometatarsus (the holotypical element in most fossil species). *Pliogyps* shares some tarsometatarsal characters with *Sarcoramphus* (anterior fossa continuing down shaft to the distal foramen, a similar size of the distal foramen and a similar shape of the hypotarsal ridge), but differs from *Sarcoramphus* in the degree of elevation of trochlea III (proximal border merging smoothly with shaft [plantar surface] in all modern skeletons of *Sarcoramphus* examined), and the amount of excavation of the

lateral parahypotarsal sulcus. *Pliogyps* also shares the following characters with *Vultur* and *Gymnogyps*: the lateral side of the area proximal to trochlea IV is inclined and the excavation of the anterior fossa extends to the distal foramen (although to a lesser degree than in *Sarcoramphus*).

Mayr and Short (1970) proposed that *Pliogyps, Vultur,* and *Gymnogyps* should be viewed as congeneric. The proportions of the tarsometatarsus of both species of *Pliogyps* are quite distinct from all species of *Gymnogyps* and *Vultur*. Considering the conservative nature of the tarsometatarsus in this family, I would maintain *Pliogyps* as separate from all other large vultures.

It does appear possible though, that the large condors (species of *Vultur* and *Gymnogyps* and probably *Geranogyps* and *Breagyps*) are all part of one radiation that differ primarily in the degree of cranial specialization (*Vultur* being primitive; *Gymnogyps* and *Breagyps* more specialized, Jollie 1977: 110; *Geranogyps* unknown). Fisher (1944, 1946) discusses a number of characters of the skull and locomotor apparatus that unites the condors as a group separate from the more primitive genera *Cathartes* and *Coragyps*.

Acknowledgments

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